IEC Laboratory

He^+ Irradiation of Single Crystal Tungsten in the Materials Irradiation Experiment

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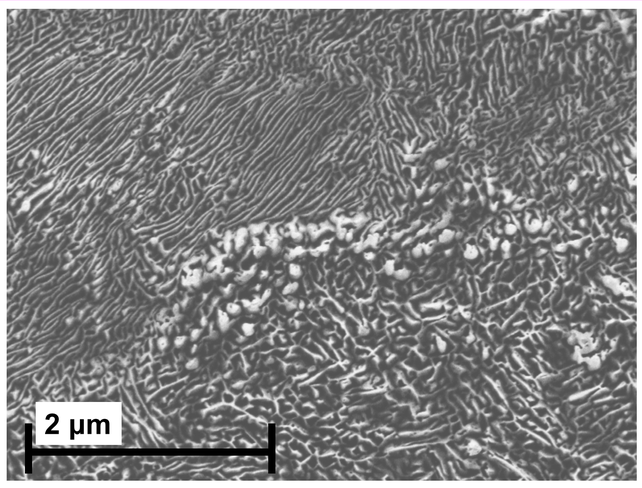
1. Introduction and Motivation

•How will tungsten (W) behave in a fusion reactor? The Materials Irradiation Experiment (MITE-E) simulates the conditions—temperatures >500°C and helium ion bombardment so W samples can be tested

•Previous tests revealed complicated structures form on polycrystalline W (PCW) that take a different shape on each grain



Adapted from Fig. 10, Zenobia, Garrison, Kulcinski. JNM V 425, I 1–3, 2012, P 83–92

2. Research Objectives

•Irradiate (110) single crystal tungsten (SCW) because it is a simpler system than PCW

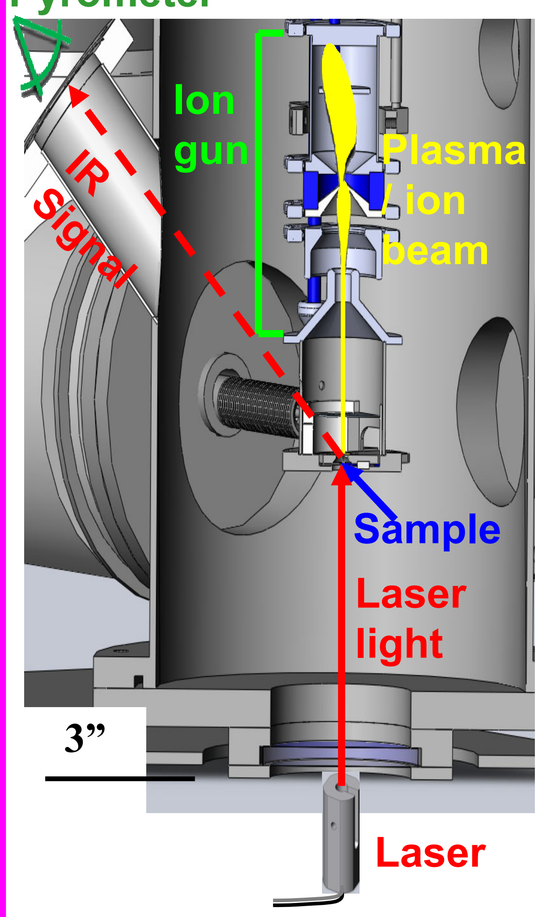
•Learn about the formation of the grass structure

•Compare two different sample surface pre-irradiation treatments

3. Research Methods

•SCW samples were irradiated with He in the MITE-E

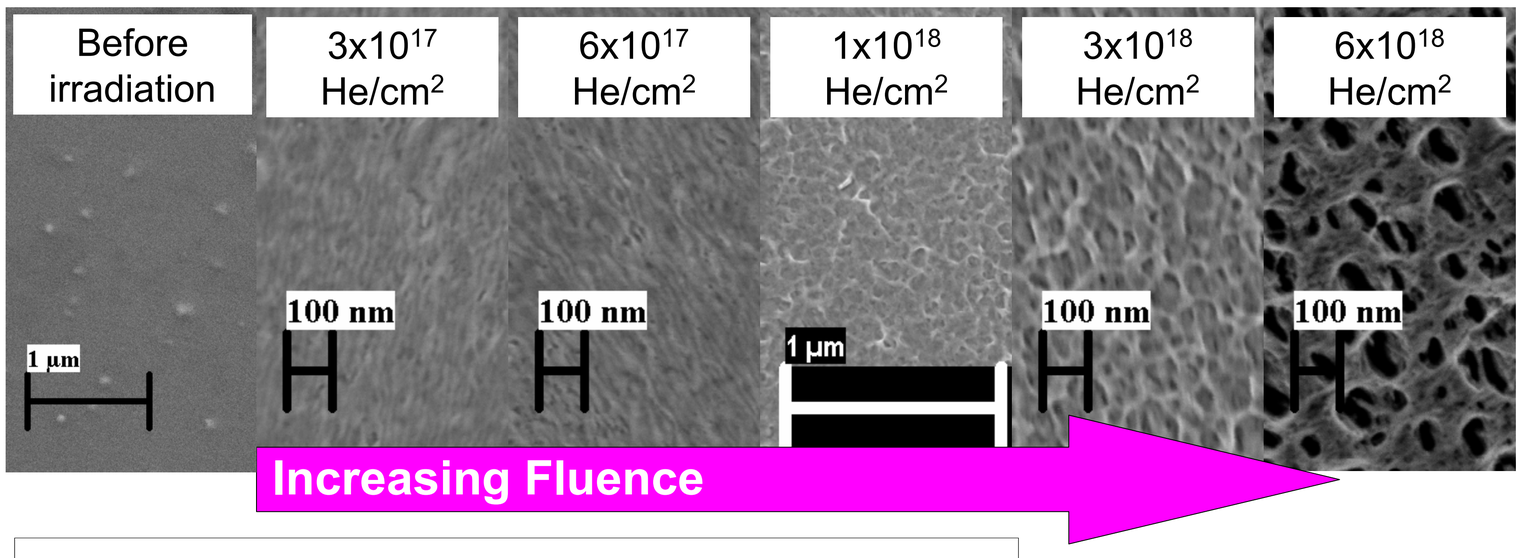
•Pre- and post-irradiation analysis was done with a scanning electron microscope



Solidworks™ model of the MITE-E

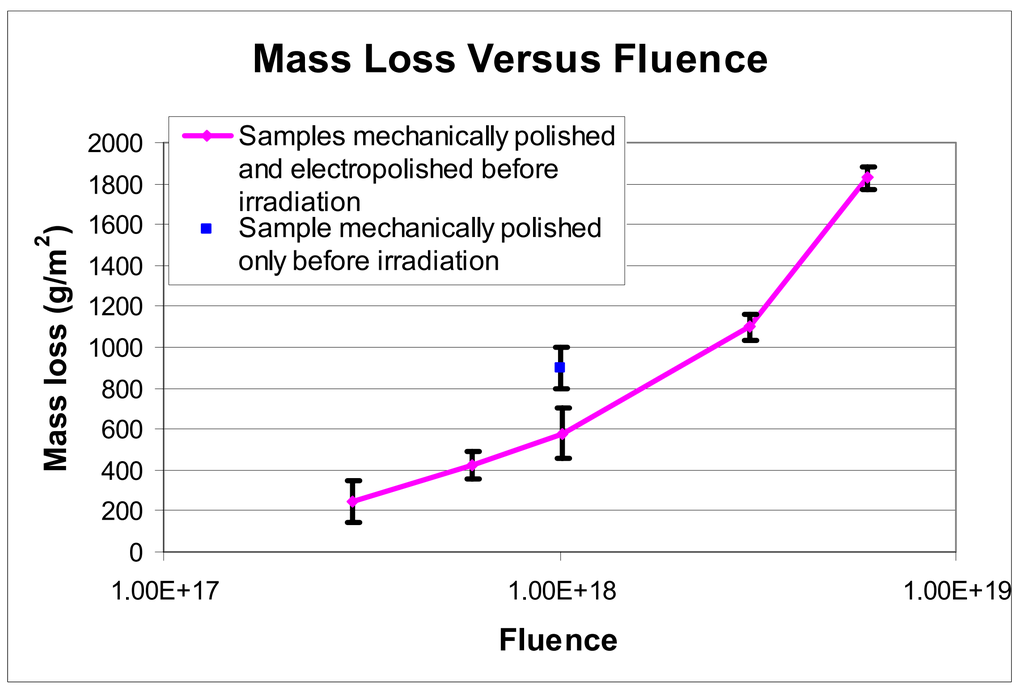
4. Results

•(110) SCW samples were irradiated with 30 keV He ions at 900 °C



Before irradiation all samples were mechanically polished and then electropolished.

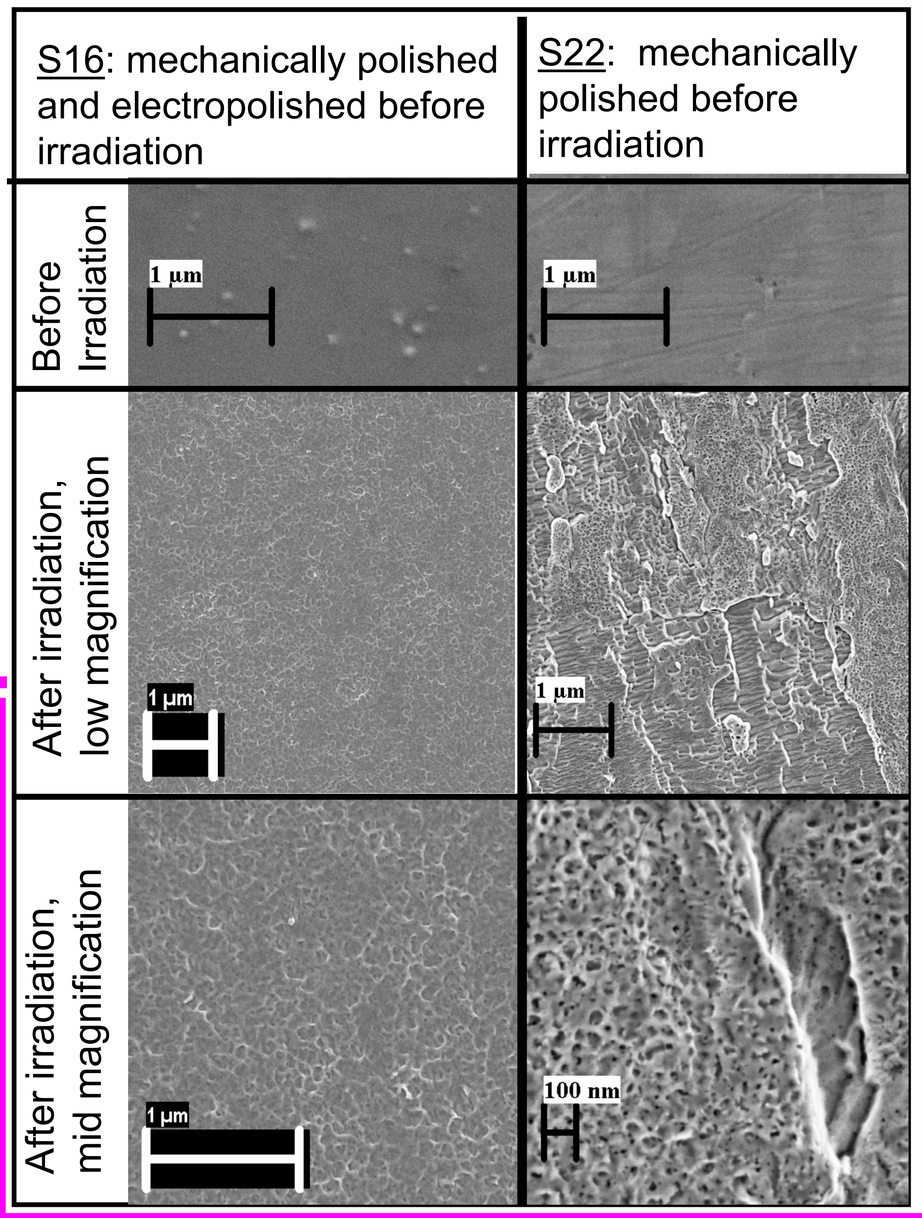
Pore size increases with increasing fluence.



•Mass loss increased with increasing fluence.

•At the same fluence, the sample that was not electropolished lost more mass than the sample that was electropolished.

Different surface pre-irradiation treatments resulted in vastly different surface morphologies after irradiation with 30 keV He^+ to $1x10^{18}$ He/cm^2 at 900 °C.



5. Conclusions

•The (110) SCW samples
- **•show a trend of increased mass loss with increased He fluence**
- **•did not develop the grass structure that was seen previously on certain grains of PCW**

•Irradiated morphology is dependent on pre-irradiation sample surface condition

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